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JUPITER-CYCLICAL RAINFALL.

BY PLINY EARLE CHASE, PROFESSOR OF PHYSICS IN HAVERFORD COLLEGE.

(Read before the American Philosophical Society, June 19th, 1874.)

The records of daily rainfall for twenty-seven years, at "Husband's" Station, Barbadoes, for which I am indebted to the courtesy of His Excellency Governor Rawson W. Rawson, C. B., have enabled me to extend my cyclical researches, and to discover some new and interesting features in the cosmical disturbances of local meteorology.

Although my previous investigations have convinced me that each of the planets exerts, on our atmospheric currents, an appreciable influence, which might be usefully formulated for any given station, provided the observations were enough extended, I have thought it best to confine myself mostly to the study of such weather modifications as are dependent upon Jupiter and the moon.

Those who are accustomed to think of simple tidal disturbances as the only ones to which we can reasonably look for planetary influence, and even those who are also willing to attach some importance to the modification of atmospheric elasticity by direct attraction, are doubtless prepared to believe, on sufficient evidence, that the moon may affect our winds and storms to a slight degree, while they are extremely skeptical,

TABLE I.

Normal Percentages of Rainfall at Barbadoes in Jovian Synodic Years.

	1847–55.	1855–63.	1863–72.	1847–58.	1859–72.	1847–72.
1	124	132	82	111	110	112
2	110	151	88	107	125	116
3	102	156	93	101	131	116
4	98	151	89	94	131	112
5	102	137	78	91	119	105
6	107	124	70	99	102	100
7	106	121	73	108	91	100
8	95	122	87	110	91	101
9	75	121	102	101	95	98
10	62	120	109	94	92	96
11	67	123	119	101	102	101
12	77	117	132	107	109	108
13	86	95	139	105	107	106
14	99	75	139	102	104	103
15	100	70	137	101	104	103
16	99	69	129	99	100	99
17	92	65	124	94	94	94
18	83	64	123	88	92	90
19	74	69	114	81	90	86
20	68	75	100	74	87	81
21	68	77	90	72	84	78
22	82	76	84	80	81	80
23	109	82	84	97	87	92
24	135	90	89	113	98	106
25	141	84	97	116	100	108
26	126	76	99	105	98	102
27	114	82	94	96	99	98
28	122	85	82	102	96	99
29	142	88	78	120	87	103
30	142	104	76	126	91	108

or altogether incredulous as to any traceable influence exerted by either of the primary planets.

But if we admit the possibility of ethereal rotation, or tendency to rotation, and especially if we consider how much we have yet to learn concerning the properties of elastic fluids, we may reasonably look for important disturbances from the cumulative effects of the undulations which are exerted by planetary action. Those disturbances, however, may be so modified by the daily fluctuations of the lunar tides, by differences in the stratification of the atmospheric currents, and by abnormal local influences of various kinds, as to obscure, either wholly or in part, all traces of cyclical regularity in their alternations of maxima and minima.

In the accompanying comparative tables there are both accordances and discordances, for which I can account in no other way than by the hypothesis of cumulative aerial waves, excited by the combined action of the two constituent orbs of our binary star, Sun and Jupiter. The magnitude of the flexures in the several rain-curves seems too great, the resemblances and gradations in order of magnitude too marked, the approximations to consistent regularity too uniform to be merely accidental. The deviations, however, from seemingly normal curvature are

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TABLE II.

Normal Percentages of Rainfall at various Stations in Jovian Synodic years.

	Greenwich, 1815–69.	Philad'a, 1826–74.	Lisbon, 1854–70.	S. Francisco, 1849–72.	"Husband's" 1847–72.	Average.
1.	100	105	81	118	112	103
2.	102	102	88	136	116	109
3.	100	99	99	132	116	109
4.	98	100	108	111	112	106
5.	99	101	110	99	105	103
6.	102	101	99	96	100	100
7.	104	98	86	85	100	95
8.	102	96	84	71	101	91
9.	97	95	96	76	98	92
10.	91	95	107	108	96	99
11.	90	99	112	141	101	109
12.	94	106	113	141	108	112
13.	97	113	115	118	106	110
14.	95	115	120	107	103	108
15.	92	110	122	104	103	106
16.	90	103	117	87	99	99
17.	92	98	103	67	94	91
18.	97	100	86	63	90	87
19.	100	103	76	69	86	87
20.	104	104	76	73	81	88
21.	109	101	81	79	78	90
22.	114	96	88	84	80	92
23.	115	91	96	87	92	93
24.	111	88	103	90	106	100
25.	105	88	108	98	108	101
26.	103	90	113	114	102	104
27.	102	94	116	129	98	108
23.	100	99	112	119	99	106
29.	97	103	98	98	103	100
80.	97	106	84	98	108	99

so great and so frequent, that my convictions of causal nexus are often wavering. I cannot expect that others, who have been less interested in the study of cyclical meteorology, will accept my qualified belief in systematic disturbances by Jupiter or other planets, until a sufficient number of observations have been compared at a sufficient number of stations, to furnish data for successful prediction.

Notwithstanding my persuasion that such data will be at some time attainable, I see, as yet, few encouraging indications of any conclusive and satisfactory termination for my researches in this particular direction. This very vagueness and lack of certainty furnishes a new and somewhat unexpected argument in favor of appreciable lunar weather-action ; for, if the tabulation of rainfall in planetary cycles had not shown so great deviations from uniformity, the regularity might, perhaps, have been regarded as an accidental resultant from some unknown law of harmonic functions, entirely independent of the influence assumed as a supposed cause. The impossibility of explaining the regularity by simple tidal action would have fully justified such skepticism.

But when we find that the lunar tabulations bring out such accordances as I have already shown (Proc. Amer. Phil. Soc., x, 436—9, 523—37 ; xi, 203 ; xii, 38—9, 178—90, 523—9, 556—9), while the Jovian influence, although possibly greater in point of magnitude, is more questionable and more easily overcome or hidden, I think we have good reason to consider the fact of lunar influence as practically demonstrated, and to hope, at no distant day, for a valuable extension of our weather-forecasts by means of that influence.

Comparing the several sets of normals in these tables, by noting the agreements or disagreements in the excess or deficiency of average rainfall at corresponding periods, we find no marked evidence of resemblance in the nine-years' groupings ; but in the twelve-year groups, corresponding nearly to a Jovian year, there are eighteen agreements to twelve disagreements, and there is a degree of resemblance in the aspect of the plotted curves which it is difficult to believe accidental. A similar comparison shows a similarity of character between the curves at Philadelphia, Lisbon, San Francisco and Barbadoes, and an opposition between each of them and the higher-latitude curve of Greenwich.

CYCLICAL RAINFALL AT BARBADOES.

By Pliny Earle Chase.

(*Read before the American Philosophical Society, June 19th, 1874.*)

I confess to a feeling of some disappointment at the first results of my examination of the lunar monthly rainfall at "Husband's" Station in the island of Barbadoes. If I had no more satisfactory evidence of cyclical regularity, and if further study had not enabled me to eliminate some of